

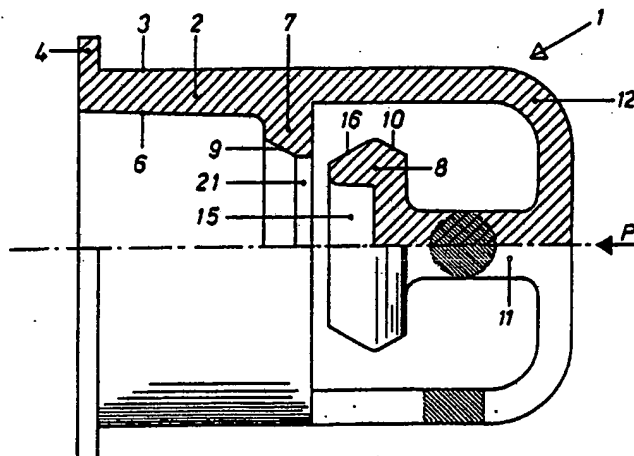
PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>4</sup> : <b>F16K 15/14, B65D 35/50</b>	<b>A1</b>	(11) International Publication Number: <b>WO 89/ 01104</b> (43) International Publication Date: 9 February 1989 (09.02.89)
<p>(21) International Application Number: PCT/DK88/00131</p> <p>(22) International Filing Date: 5 August 1988 (05.08.88)</p> <p>(31) Priority Application Number: 4112/87</p> <p>(32) Priority Date: 6 August 1987 (06.08.87)</p> <p>(33) Priority Country: DK</p> <p>(71) Applicant (for all designated States except US): PANTHER PLAST A/S [DK/DK]; Københavnsvej 74, DK-4760 Vordingborg (DK).</p> <p>(72) Inventor; and</p> <p>(75) Inventor/Applicant (for US only) : LUND, Carsten [DK/DK]; Skoleparken 11, DK-4760 Vordingborg (DK).</p> <p>(74) Agent: LARSEN &amp; BIRKEHOLM A/S SKANDINAVISK PATENTBUREAU ; Niels Hemmingsens Gade 32, P.O. Box 39, DK-1002 Copenhagen K (DK).</p>	<p>(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BG, BJ (OAPI patent), BR, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE, DE (European patent), DK, FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.</p> <p><b>Published</b> With international search report. In English translation (filed in Danish).</p>	

(54) Title: ONE-WAY VALVE, METHOD FOR THE PRODUCTION THEREOF AND THE USE OF THE VALVE



## (57) Abstract

A one-way valve with valve seating (7), valve piston (8) and a spring element (12) is produced as a one-piece plastic part. The spring element is tensioned by the valve piston being pressed through the valve opening (21), after which the valve's sealing surface (10) rests against the sealing surface (9) of the valve seating. The valve is intended for use as an anti-reflux-suction valve for dispensers. The valve is held closed by that pressure which arises in the valve stem (11) from the spring legs (12), and passage through the valve is achieved by increasing the pressure under the piston until this is lifted. The invention also relates to the production of the valve.

***FOR THE PURPOSES OF INFORMATION ONLY***

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	ML	Mali
AU	Australia	GA	Gabon	MR	Mauritania
BB	Barbados	GB	United Kingdom	MW	Malawi
BE	Belgium	HU	Hungary	NL	Netherlands
BG	Bulgaria	IT	Italy	NO	Norway
BJ	Benin	JP	Japan	RO	Romania
BR	Brazil	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	LI	Liechtenstein	SN	Senegal
CH	Switzerland	LK	Sri Lanka	SU	Soviet Union
CM	Cameroon	LU	Luxembourg	TD	Chad
DE	Germany, Federal Republic of	MC	Monaco	TG	Togo
DK	Denmark	MG	Madagascar	US	United States of America
FI	Finland				

ONE-WAY VALVE, METHOD FOR THE PRODUCTION THEREOF AND THE  
USE OF THE VALVE.

The invention relates to a one-way valve of the kind  
5 presented in the preamble to claim 1. Such valves,  
often called non-return valves, are to be found in  
innumerable different embodiments, frequently adapted  
to suit certain applications. Known one-way valves  
consist of a number of individual parts which, after  
10 their production, are assembled to form the finished  
valve. This increases both the production time and  
the production cost.

Packing, e.g. such as toothpaste tubes, shampoo con-  
15 tainers and soap containers of plastic, eye-drop dis-  
pensers of plastic or rubber, tubes for adhesives,  
cartridges for fillers, and on the whole dispensers  
with which the portioning out is carried out by de-  
forming (squeezing) the container or outlet stub, have  
20 many practical advantages, but also drawbacks. One of  
the drawbacks is that a reflux suction takes place  
when the container is released and the plastic or rub-  
ber container or outlet stub springs back to its ori-  
ginal shape. Reflux suction can be avoided if the dis-  
25 penser is made of a plastic deformable material, for  
example soft metal alloys. For economic reasons, and  
in order to avoid the pollution of the product with  
metal from the dispenser wall, elastic deformable mat-  
erials such as plastic or rubber are used to a great  
30 extent for dispensers. The reflux suction which arises  
can give rise to the pollution of the product in the  
container, a reduction of the lifetime of the product  
and contribute towards the blocking of the outlet  
stub, the reason being that the product hardens or

goes dry in the tube, etc. Moreover, where non-transparent containers such as toothpaste tubes or glue tubes are concerned, reflux suction has the great disadvantage that the user has no immediate impression of how much is remaining in the container when it resumes its original shape. A further drawback as a result of reflux suction is that the container must often first be emptied of air by squeezing it before the remaining part of the contents can be portioned out as desired.

10

The object of the invention is to present a one-way valve so that reflux suction can be avoided, said valve being produced at very low cost, thus enabling it to be used in connection with countless different embodiments for packaging or dispensers, for example throw-away packing for fluids, ointments, creams and pastes etc., which are dosed and consumed over a period of time.

20 This is achieved by designing the valve according to the invention as described more closely and characterized in claim 1. The configuration of the valve results in it being able to be produced by normal injection moulding, and in such a way that apart from the moulding it requires no finishing work, or that  
25 after the moulding there is no assembly to be carried out of individual parts. By means of a simple pressure, which can be effected mechanically and completely without problems, for example immediately after  
30 moulding of the valve or in connection with the filling of the dispenser, the piston is mounted in place in the valve seating.

By configuring the valve according to the invention as

characterized in claim 2 or 3, the possibility is provided for adequate clearance the whole way through the valve, so that the medium which is to pass is unhindered in its passage through the valve. The spring/  
5 springs and/or the valve stem is hereby deformed, whereby the springs are tensioned. The elastic deformed parts will seek to return to their original shape, and will hereby give the valve a closing pressure depending on the extent of the deformation. The valve  
10 is opened by increasing the pressure under the piston until this is greater than the torsion in the valve stem from the spring legs, whereby the piston is lifted.

15 With the configuration of the piston's cross-sectional profile as presented and characterized in claim 4, the one annular surface can constitute the piston's sealing surface against the valve seating, while the other annular surface ensures that the piston can be  
20 pressed correctly through the valve opening.

By configuring the valve according to the invention as characterized in claim 5, it is achieved that the piston can be elastically deformed and pressed through  
25 the clearance in the valve seating without any great use of force, and without damaging the piston, so that with this finalizing of the valve it does not suffer any damage. At the same time herewith, the material consumption and the weight of the valve are reduced,  
30 without any reduction in the function or the strength.

The valve according to the invention can be configured as characterized in claim 6. The means of securing can be a thread, a weld-edge for ultrasonic welding, a

glue surface or the like, so that the valve can be secured in the outlet opening of a container in a known manner.

5 The valve according to the invention may also be configured as characterized in claim 7, i.e. the valve is completely integrated in the outlet opening or the outlet stub. The production costs involved in the manufacture of items in large numbers are hereby further  
10 reduced. Furthermore, the speed of production is increased and one avoids having to assemble the parts, i.e. the valve and the dispenser, after they have been produced.

15 The invention also relates to a method for the production of the valve. The valve can be produced as characterized in claim 8 or claim 9, all depending on whether the valve is produced as a single part or as an integral part in one with the dispenser.

20 The valve according to the invention can naturally be used as one-way valve for any medium, whether this be air, fluid or cream. However, as presented in claim 10, the valve is produced chiefly for use as an anti  
25 -reflux-suction valve for dispensers.

The invention will now be described in more detail with reference to the drawing, which shows a preferred embodiment, in that

30

fig. 1 shows a valve according to the invention, partly in section and as the valve will appear when it is injection moulded,

fig. 2 shows a valve according to the invention, partly in section and with the valve piston in the final position, and

- 5 fig. 3 shows an example of the application of the valve shown in fig. 1.

In figs. 1 and 2 of the drawing is seen a valve according to the invention produced in one by injection  
10 moulding in a plastic or rubber material, said material retaining its torsional/springiness characteristics for long into the future. Many known materials have this characteristic, e.g. polyethylene, Nylon or synthetic rubber.

15

As shown in fig. 1, the valve is moulded with a tubular housing 2 which, on the outer side 3, can have an annular weld-edge 4 for ultrasonic welding or heat  
20 welding, or can be moulded with thread 5 as shown in fig. 2 for screwing in. Naturally, the valve can also be glued or melted firmly in the outlet opening of the dispenser in which it is to be used.

The right-hand part of the valve comprises two spring  
25 legs 12, which like a bridge extend over the central opening in the valve from the valve seating 7. At the top point of the bridge, the spring legs 12 extend to form a common valve stem 11, which in turn extends into the actual valve piston 8. The cross-sectional  
30 profile 13 of the bridge 11 is shown circular, and the cross-sectional profile 14 of the spring legs 12 is shown rectangular, but these parts can naturally have any other expedient shape.

- The valve piston 8 has the customary circular cross-sectional form with a certain thickness and with a largest diameter around the middle of the piston, and thereafter decreasing diameters to both sides which give rise to two annular surfaces 10,16. Centrally in the piston there is a cavity 15 which increases the flexibility of the valve piston's annular ring edge 22.
- 10 In the left-hand part of the valve 1 there is normally a smooth inner surface 6, so that the through-going clearance in the valve is narrowed down only by the valve seating 7 itself.
- 15 When the valve seating is to be used as a one-way valve, a mechanical pressure is applied to it in the direction shown by the arrow P while the valve housing is secured. The valve piston is thus pressed through the central opening 21, in that the parts are so flexible that the piston, for reasons of the inclined, annular surface 16, can be pressed through the opening 21 without any problems, and the second of the valve piston's annular surfaces 10 will now rest on the sealing surface 9 of the valve seating. Consequently, the sealing is achieved by sealing between the valve piston's surface 10 and the valve seating's surface 9. During this operation, the spring legs 12 are deformed so that tension arises in the valve stem 11, which seeks to close the valve as shown in fig. 2.
- 20
- 25
- 30 Passage through the valve is achieved by increasing the pressure under the valve piston, so that this is lifted from the valve seating 7 in the direction shown by the arrow 20 in fig. 2.



Fig. 3 of the drawing shows a valve according to fig. 1 mounted and glued or welded firmly in a tube, e.g a toothpaste tube 17. The outside of tube's stub 18 is provided with a thread 19 for normal tube cap. When the tube 17 is squeezed together, the valve piston is lifted, thus enabling a suitable amount of toothpaste to be dispensed in the normal manner. As soon as the pressure on the sides of the toothpaste tube is relieved, the pressure under the valve piston disappears and, as discussed earlier, the spring legs are able to close the valve without any reflux suction taking place, and the tube will retain its squeezed shape. When packing for a low-viscosity product is involved, for example eye-drops, liquid soap or shampoo, the valve can be configured without the spring force (tension) in the valve stem and/or the spring legs, in that the valve is closed by the reduced pressure in the packing, said reduced pressure arising in the packing's own attempt to regain its undeformed shape. In this connection, the packing must naturally have a certain stiffness, i.e. it must be produced of, for example, HD-polyethylene (High Density polyethylene) or similar material, but the actual valve piston needs only a control arrangement which positions the piston.

The embodiments of the invention shown in figs. 1-3 constitute an independent valve unit. The valve can also be configured in one with the container or the stub, so that the tubular housing 2 is completely integrated with the dispenser, and in such a way that the valve is produced at the same time as and in one with the dispenser or its outlet stub, or at the same time as a part of the outlet stub.

## C L A I M S

1. One-way valve comprising a valve seating, a valve piston herefor and an element arranged to hold the piston in place at the valve seating, c h a r a c t -  
5 e r i z e d in that the valve seating (7), the piston (8) and the element (12) which holds the piston in place are configured in one piece of plastic, rubber or other flexible and mouldable material, and in  
10 that the element (12) is arranged to be brought into place by flexible deformation when the valve piston, under the application of a pressure force (P), is pressed through a central opening (21) in the valve seating, said opening having a smaller clearance area  
15 than the largest cross-sectional area of the piston.
2. Valve according to claim 1, c h a r a c t e r -  
i z e d in that the element which holds the piston in place is configured as a number of legs (12) which  
20 extend from the valve seating (7), and meet in a common valve stem (11) which supports the valve piston (8), and also in that the legs (12) and/or the valve stem (11) is deformed elastically when the piston is brought into place.
- 25
3. Valve according to claim 2, c h a r a c t e r -  
i z e d in that the spring element consists of two legs (12) which together form a bridge over the central opening (21), and where the valve stem (11) ex-  
30 tends from the top point of the bridge, and moreover that the legs (12) have a cross-sectional area which is considerably smaller than the cross-sectional area of the central opening (21).

4. Valve according to any of the claims 1-3,  
c h a r a c t e r i z e d in that the piston (8) is  
a circular disc, but with different diameters across  
the disc's thickness, the result being that it has  
5 the largest diameter in the middle and decreasing  
diameters towards both side surfaces, this giving rise  
to two annular surfaces (10,16).

5. Valve according to any of the claims 1-4,  
10 c h a r a c t e r i z e d in that the side of the  
piston which turns away from the stem (11) is provid-  
ed with a ring-shaped edge (22) which, on its outer  
side, bears the one of the annular surfaces (16) and  
which defines a central cavity (15) in the piston.

15 6. Valve according to any of the claims 1-5,  
c h a r a c t e r i z e d in that the valve is mould-  
ed as an independent unit (1), and that securing means  
(4,5) are provided on the outer side of the valve's  
20 valve housing (2).

7. Valve according to any of the claims 1-5,  
c h a r a c t e r i z e d in that it is moulded in  
one with an outlet opening or an outlet stub for a  
25 container, or in one with a container wall.

8. Method for the production of a valve according to  
any of the claims 1-6, c h a r a c t e r i z e d in  
that the valve is produced by injection moulding of  
30 plastic as an independent unit, and that after the  
necessary cooling time and/or hardening time it is  
finalized with a mechanical influence, whereby the  
piston is pressed through the valve seating's central  
opening and the spring element is tensioned.

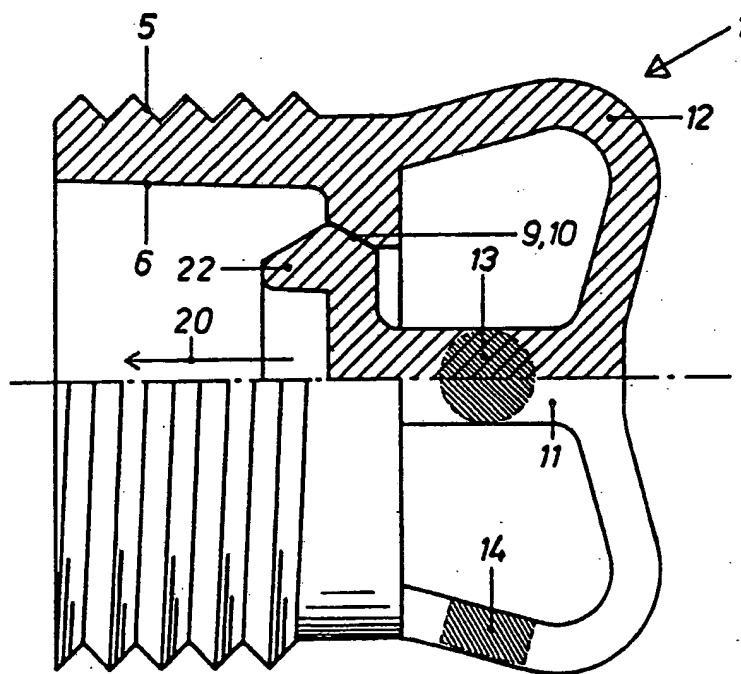
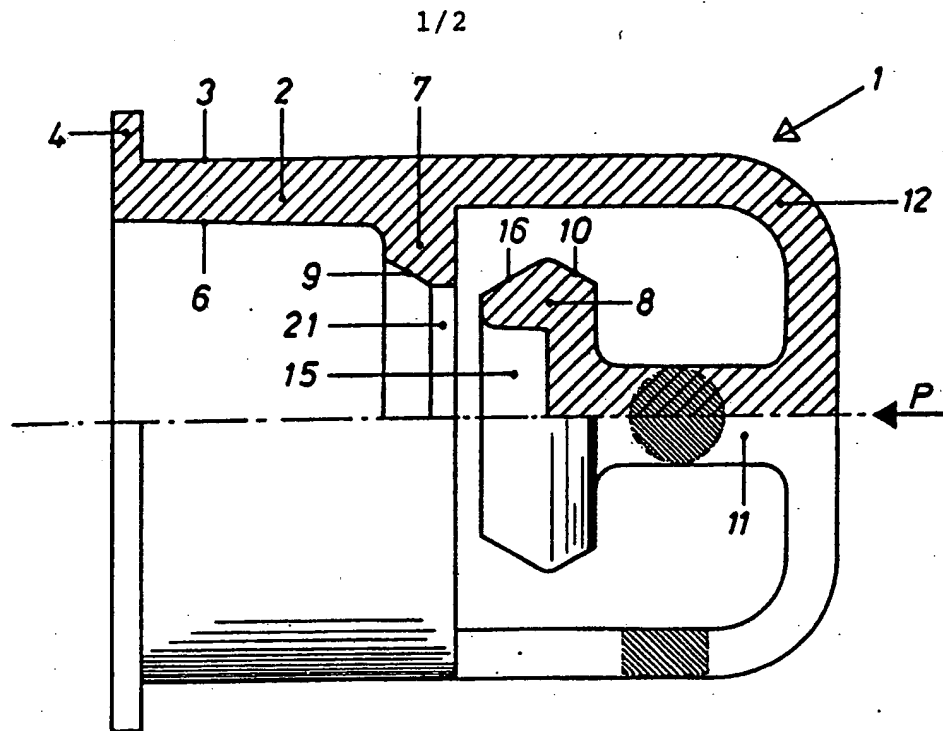
10

9. Method for the production of a valve according to any of the claims, 1-5 or 7, characterized in that it is produced by injection moulding of plastic in one with an outlet opening or an outlet stub for a container or in one with the container, and that after the necessary cooling time or hardening time it is finalized with a mechanical influence, whereby the piston is pressed through the valve seating's central opening and the spring element is tensioned.

10

10. Use of the valve according to any of the claims 1-7 as an anti-reflux-suction valve for a dispenser for a liquid or paste-formed medium.

15



2/2

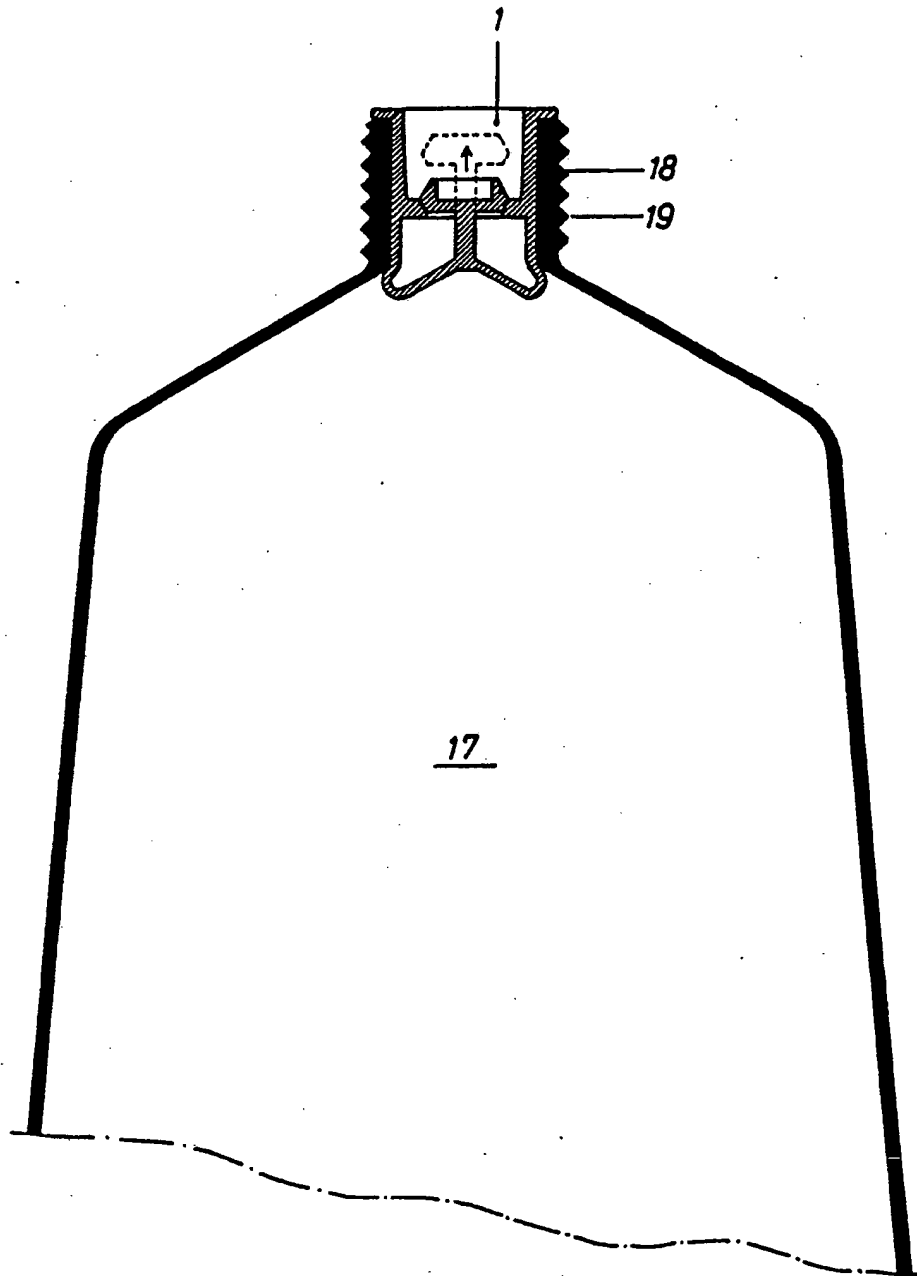
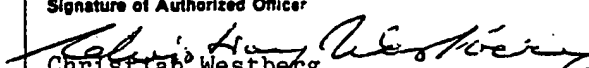


Fig. 3

# INTERNATIONAL SEARCH REPORT

International Application No PCT/DK88/00131

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) *		
According to International Patent Classification (IPC) or to both National Classification and IPC 4		
F 16 K 15/14, B 65 D 35/50		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched 7		
Classification System	Classification Symbols	
IPC 4	F 16 K 15/14, 21/04; B 65 D 35/44-/50	
US C1	137:505, 505.11, 516.11, 517, 528, 843, 845	
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched *		
SE, NO, DK, FI classes as above		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT *</b>		
Category *	Citation of Document, 11 with indication, where appropriate, of the relevant passages 12	Relevant to Claim No. 13
X	DE, A1, 2 704 164 (BACHMANN, GUNTHER) 3 August 1978 See fig. 1-3, p. 2, lines 17-29, p. 3, 2nd and 3rd paragraph.	1-3
Y	FR, A, 2 142 846 (BARSANTI, JEAN ET AL) 2 February 1973 See p. 2, lines 22-35. & DE, 2230642	1
Y	SE, A, 356 441 (CONTINENTAL CAN COMPANY INC.) 28 May 1973 See p. 5, last paragraph, fig. 2, 7. & NL, 7006893 DE, 2010650 US, 3586068 BE, 750638	1-2
A	CH, A5, 644 678 (ESSEX CHEMICAL CORPORATION) 15 August 1984 See figures, p. 3, col. 1, line 11 to p. 4, col. 2, line 9.	1
.../...		
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>* Special categories of cited documents: 10</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>"&amp;" document member of the same patent family</p> </div> </div>		
<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
1988-11-09	1988 -11- 11	
International Searching Authority	Signature of Authorized Officer	
Swedish Patent Office	 Christian Westberg	

## III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	DE, A1, 3 331 529 (ESSEX CHEMICAL CORPORATION) 21 March 1985 See fig. 7-10	1



**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**